KEY TRENDS

ADA Economics
Effective analysis to manage financial risk

Digitalisation

How data shape risk-taking behaviour and what it means for public policy

This report is a first attempt at pulling together our research findings on how digitalisation affects humans, and what this could imply for the economy in the long run.

Digitalisation, from a human point of view, at a simple level, means learning to manage the information explosion we are all exposed to, constantly, and at a growing pace as time goes by. The following are the most important key messages that we hope you will remember from our report:

Living with a lot more information/data/social digital interactions means that we all need more energy to process these interactions in order to verify their quality, understand them, and decide whether to use them or not. This is not an optional process; we all do it because our brains are wired to constantly process external events in order to assess their value and use. So, at a basic level, we need to acknowledge the cost that this imposes on people in terms of energy, and be aware that a certain method to address this volume is needed to do so efficiently.

The verification of the quality of information we are exposed to is difficult, and we should be aware of the unevenness of the resources and conditions we face. Consider the following: digital technology makes it easier to segment users and, therefore, segment information channels; there are serious financial and educational barriers that make verification difficult in some parts of society; and there is an imbalance in the resources deployed to learn and use big data within the private sector, and between private and public sectors.

We should aim to avoid a vicious circle that affects the bottom half of the income distribution related to this information overload. The poorer segment of society faces tighter financial, educational and time constraints in assisting their children to manage and learn in this world, and they face the same challenges as adults. This, over time, is socially unjust, undermines professional development and, ultimately, will undermine the democratic functioning of society as well.

We all give more importance to what we see than what we cannot see, especially if it is hard to measure. This is a key fallacy in risk assessment and it is also a misstep for policy makers, who will not understand what is not well measured. In a society with so much emphasis on data and data management, this becomes an even more dangerous bias.

There are steep challenges from all this for public policy: the practical delivery of the digital transition, and funding constraints, diverting attention, and ideological barriers to acknowledging that more and more coherent policies to support human capital are needed urgently. Ignore our advice at your peril: the cost will be high inflation and higher financial instability.

Raffaella Tenconi

March 2022
Issue no.338

Some background on the views presented here

Digitalisation is the technological leap that generates, codifies and deploys data to perfect, magnify and broaden business processes and strategic decisions. There are three key areas of consequences relevant at the macroeconomic level: direct economic consequences for GDP and its factors of production; financial market implications, of which FX, blockchain and ESG implications are the most important; and human cognitive implications.

This report builds on our earlier reports on these themes (*The long-term implications of digitalisation, 2021*; *The next decade, 2020*; *The structural change that changes everything 2019*; *A closer look at inflation and why it is not low, 2018*; *Revisiting wage convergence and its impact, 2018*; *Balance sheet inequality: has it gone too far?, 2018*) and focuses on the human cognitive implications.

ADA is not a company specialising in neuroscience or psychology; therefore, as you read this report, you should beware that we followed the same methodology that we apply to economic research normally, on a broader spectrum of questions, and we cross linked these findings with what we have learned from our proprietary surveys and other anecdotal experience collected over time. Our knowledge, in parts, is thus limited, but does not prevent us from highlighting real and critically important links that are too overlooked when discussing the digital transformation.

This report pulls together the diverse research we have conducted since the inception of ADA. It all started as we wanted to understand how people vote for politicians. To do so, we wanted to understand how people choose, in a situation of significant uncertainty, something that will probably have material implications for their livelihoods. The way we approached this question was to, first, acquaint ourselves with what neuroscience could tell us about decision making and risk taking; then we developed structured surveys across Europe to reveal what considerations active voters were taking into account ahead of elections; and, subsequently, we worked on methods of communicating, manipulating and institutionalising information and data in two distinct areas: maternity assistance and decisions, and machine learning algorithms for pricing strategies. Although these diverse areas may appear fairly unrelated to each other; in reality, they all share a fundamental structure: information gathering, information organisation and manipulation, and the evaluation of decisions based on information, under uncertainty.

After all the investigations we have been doing, it appears to us that neglecting the implications of digitalisation on humans – and, by extension, their decision making – is a serious mistake. On a personal level, it would be equivalent to underestimating the genuine challenge that everybody is facing today already. On a macroeconomic level, it is equivalent to overlooking a very powerful trend that can make the difference between the success or failure of the deployment of digitalisation in the economy.

At the time of writing, Russia's aggression against Ukraine is plainly aiming to complete the destruction of the country, and is putting the safety of Ukraine's nuclear power plants in jeopardy. It may, therefore, appear misplaced to either talk about digitalisation, given the probable energy rationing in Europe in the next 12 months, and/or inadequate to focus on what could appear to be soft issues related to human emotions and information management.

On the first point, our response is: digitalisation will not stop, even if Russia halts its gas supplies to Europe completely. The US, China and India are making fast advancements in the deployment of technology, and there is nothing that suggests that Europe will not follow those steps.

On the second issue, we hope that, by the time you finish reading this report, you will see why economic growth and financial stability are tightly intertwined with people's ability to process information, the quality of information available to them, and their physical-mental-emotional well-being, which affects their risk-taking behaviour directly. This duality has always been true – even before the current technological leap – and it becomes even more important as digitalisation, *de*

facto, means that society even more influenced by data: generation, visibility and manipulation. As a result, perhaps there is no better time, than today, to recalibrate the emphasis on people: their abilities, their hopes, and their fears.

In recent years, our position has been that it is imperative to recalibrate policy attention towards fostering competition at all levels and supporting human capital. Human capital support is needed on many levels: education, public administration, labour market regulation, but the one that in our view is most important and dangerously overlooked is maternity. Building a world based on data requires, first of all, putting women in a much stronger footing to fulfil their roles of primary caregivers at best. Today, we should instead acknowledge that most of the efforts deployed to support maternity are half hearted at best and their lack of effectiveness is painfully visible in low fertility rates, high poverty rates among families with children and still too low labour market participation of women, especially those with high education attainment.

The recent explosion of the Russian attacks on Ukraine add urgency to the message of this report. Profound consequences and challenges lie ahead, as a result of this conflict and its plausible broadening. Europe's diverse, democratic and socially-responsible identity can be supported and sharpened, and it can strengthen its force as a source of competitive advantage globally, if it understands the human challenges brought about by digitalisation and acts ambitiously to address them.

Information: why, how, and its effects

Humans are built to gather, store and process information of all kinds, from the moment their senses allow, which means before birth. This process is a necessity of life. At the basic level, this is needed for survival: keeping us away from harm. It is also necessary for thriving, as we ultimately seek pleasure and minimise harm, and it is essential for social interaction.

To do all this, three essential ingredients are needed: energy, time and other people. It is important to emphasise that processing information at all levels and at any age is hard, and this is what we mean when we highlight that it is energy consuming. It is equally important to highlight that we learn over time, that information screening is a constant activity for as long as we live, and that the more we do it, the better we should get (although this is not necessarily the case, unfortunately). Last but not least, guidance from others is absolutely imperative, as is personal direct experience.

Gathering and simple storing – that is, remembering – facts and events are not sufficient for humans, nor it would be an efficient approach given the magnitude of information brains need to process over a life time. **Emotions are the vehicle that humans use to organise information, so to speak, in a way that can be retrieved efficiently when needed**. It is important and most efficient to remember **if** something harmed us: say, fire burns a hand, versus remembering **the day** that we first understood that fire burns. The emphasis is on a theme and our reaction – fire/danger – relative to a point in time and the action – April 1980/fire.

"Storing information by theme", so to speak, may appear an obvious at first, but it is not. Think about this as a choice in information management, just like you would when you organise observations in excel. Organisation based on time, to some extent, seems the most obvious way to organise data: it flows naturally with life and, in many ways, it is the best approach if we have relatively few items to organise; for example, if you want to remember key events for your family. However, it does not work well if you have millions and millions of events of slightly different shapes, but with some relationship between them. In this case, time is not the best way to organise that information – thematic groups is a more effective way; and, for humans, in particular, the ultimate grouping relates to emotions.

From a data management perspective, emotions are an efficient way of organising data/information.

Emotions are, *de facto*, a mechanism to guide the survival of humans: we organise information to limit harm and maximise happiness. As a consequence of the "emotional process" the emotional state or development of a person has strong implications on the person's ability to learn, interact in a social setting, motivational and therefore drive to achieve goals and self-regulation. Importantly, emotions have such a profound role in our behaviour and memories that events that affect us negatively influence our behaviour materially and, therefore, the choices made throughout the life of an individual, both consciously and unconsciously, unless these events are addressed, understood and mitigated, at some point.

This is the link between humans' interaction in the real & digital worlds and risk taking. The quality of information absorbed by us, and the environment in which we process this information influences our choices profoundly: employment choices, voting choices, investment choices, and procreation choices.

Reality, simplification and falsity

Assessing the truthfulness of information – both close to us and far away, but potentially relevant for us – is the next critical step, after the basic gathering and storing described above. Abstraction, complexity and truthfulness are conveyed, at a basic level, via art or imagery, in general, stories and, importantly, personal contact. People rely on other people to discern the truth from the lies, and this process begins at an early age with the assistance of parents or caregivers.

This situation changes somewhat with digital communication. Digital channels have increased the volume, and cut the price of communication; and, by doing so, they have increased the volume of material that, either intentionally or not, can be a very poor description of actual reality: simplification for entertainment; simplification to reduce the costs of production; simplification simply because the technology allows you to create a scene that looks real, but is unviable or outright dangerous if reproduced.

Truncated sequences and material that is only available online for a period of time and is later withdrawn compound the difficulties in the verification of quality. For example, a short sequence of an event may give the impression that it generated no harm; although, in reality, the actual consequences are not shown. Similarly, statements that can be interpreted as offensive (see the case of Arizona Republican Congressman Paul Gosar, in an anime video that appeared to show him attacking New York Democratic Rep. Alexandria Ocasio-Cortez, November 2021) can lead to widespread discussion; however, if the material is withdrawn quickly, many people cannot access the original material to assess its quality.

Lying is annoying and angers us on many levels. Times like today illustrate this point so very clearly. However, one cannot forget that lying is also a defence mechanism for humans: if you do not know the reaction of the other person, sometimes lying is a path to survival, or to push the other side to reveal something about their genuine intent. Widespread "lying", like in the commercial use of virtual reality (where you see things that are not there) could have very adverse effects on the population's ability to screen information quality and act on genuine information.

Digital Global overview survey on daily time spent with media average daily that internet users aged 16 to 64yrs – January 2020 snapshot

Using internet	Using social media	Watching television	Listening musign streaming services	Using a game console
6hr 43mn	2h 24m	3h 18m	1h 26m	1h 10 min

Source https://www.slideshare.net/DataReportal/digital-2020-global-digital-overview-january-2020-v01-226017535

More is not the same as more comprehensive data, nor more equally accessible data

Silos of information resources

A common view on the impact of the internet on society is that, by making any kind of information free in large amounts, very good quality information is now more easily available to a wider audience. This, in reality, is not entirely correct. It is true that a wide range of resources is now more easily accessible, and more quickly, to anyone with an internet connection. Some of this is extremely good quality, while a lot of it is very bad quality.

However, what is equally important is what kind of genuine access people have, and is the access equally distributed or equally open?

We see three types of barriers. First, with so much information available, finding the best kind (that is, the most accurate) is not self-evident, and it is somewhat distorted by the algorithms that are used to facilitate advertising services. Practical challenges, *de facto*, make it more likely that you will not necessarily find a balanced range of views, but rather a high volume of the same kinds of sources. Secondly, there are ample price barriers now and these barriers are material, given the skewed income distribution in some countries. Accessing digital libraries usually requires a fee – in the range of USD 10-20/pm, which is a low, but not insignificant amount for people in different parts of society. Thirdly, screening information quality is not a self-evident process. We can see that the younger generations do not, for example, spontaneously differentiate between primary and secondary sources of news.

Assessing the validity of a piece of information in a field where you have no genuine competence, nor does anyone in your social circle, becomes a very difficult task, and is going to be disproportionately influenced by what people think around you, even though they may all face the same constraints. As society is segregating more and more in terms of housing, schooling and job positions, it becomes difficult for those with low education job positions to interact regularly and frankly with people in more specialised fields. The same holds true on the opposite side, but it weighs more negatively on the lower income part of society because society is becoming more complex (finance, regulation and health changes) and fewer avenues are genuinely easily accessible to all. To this, we also need to consider the evolution of newspapers, where greater focus is being put on the short-term news cycle, and this, again, can function as a barrier to fact finding. The key message here is not that it is impossible for people to get access to good information; rather that the conditions are such that many have access to poor information significantly more easily in volume and over time than otherwise.

Truncated and manipulated information can be interpreted as intentionally deceptive, even when that is not the actual intent, if the audience does not have the ability to understand the reasons for both actions, and does not trust the intent behind the manipulation. The inflation rate is an example of this. The inflation rate is a standardised manipulation of actual prices. Its structure has certain limits, which can and does, in this historical time, give the impression that it is adjusted intentionally to mask reality. Is it impossible to find how the basket is created and why there can be times of divergence between perceived reality and measured reality? No, it isn't, but that does not matter as much, if many of those that do not agree with the measured assessment don't have the time or **the trust** to research it.

Allocation of time

High volumes of information require a method to digest it, but also decisions on time allocation, as we all have finite time, including children. Therefore, time spent on "bad" data is time taken away from the accumulation of "good data". As digital experiences can be highly addictive, the lack of awareness on the value and methods to use digital tools, at best, risks wasting time, instead of accumulating useful knowledge.

In the case of children, bad information and bad information management keep people behind, and increases their barriers to integrating into society and to developing a career. Emotional trauma at an early age can seriously impair social life.

There are a number of studies that document screen time exposure is significantly higher at the lower end of the income distribution; below, we report some key numbers and links to two reports that show this clearly. What is not yet well reported, but equally important, is that there is a widespread scarcity of time of parental flexibility to support children's ability to learn how to manage digital channels, which affects the vast majority of the income distribution, and persistent high stress levels among adults are, in themselves, a serious challenge to processing information and assessing risk.

Results taken from the relationship between screen time among children and lower economic status during elementary school closures due to the coronavirus disease 2019 pandemic published by BMC public health

Household income groups and caregiver changes

	All participants	Low-income level	Above-average level	*p*-value	Decreased income status	Not-decreased income status	*p*-value	Caregiver changed	Caregiver unchanged	*p*-value
	N = 217	*N* = 117	*N* = 100		*N* = 67	*N* = 150		*N* = 44	*N* = 173	
	Mean ± SD	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Children's variables										
TV frequency per week[a]	4.79 (2.46)	4.87 (2.56)	4.69 (2.35)	0.589	4.67 (2.79)	4.84 (2.31)	0.666	5.41 (2.29)	4.63 (2.49)	0.061
TV screen time per day[b]	3.27 (1.30)	3.49 (1.47)	3.02 (1.03)	0.017	3.27 (1.40)	3.27 (1.26)	0.822	3.14 (1.19)	3.31 (1.33)	0.397
Tablet PC frequency per week[a]	3.50 (2.87)	3.92 (2.98)	3.00 (2.66)	0.017	4.30 (2.83)	3.14 (2.82)	**0.006***	3.23 (2.97)	3.57 (2.85)	0.485
Tablet PC screen time per day[b]	2.76 (1.62)	3.04 (1.72)	2.43 (1.42)	**0.010***	3.36 (1.74)	2.49 (1.49)	**0.001****	2.84 (1.92)	2.74 (1.54)	0.921
Smartphone frequency per week[a]	4.55 (2.82)	5.05 (2.68)	3.97 (2.88)	**0.005****	5.27 (2.52)	4.23 (2.89)	**0.009***	5.64 (2.21)	4.28 (2.89)	**0.001****
Smartphone screen time per day[b]	3.10 (1.58)	3.52 (2.60)	1.64 (1.36)	**0.000****	3.81 (1.72)	2.78 (1.41)	**0.000****	3.57 (1.59)	2.98 (1.56)	0.031
Caregiver's variables										
Subjective stress scores[a]	5.49 (2.56)	5.93 (2.64)	4.98 (2.37)	**0.006***	5.97 (2.84)	5.28 (2.40)	0.066	6.36 (2.39)	5.27 (2.58)	**0.011***
Patient Health Questionnaire −9 [a]	5.33 (5.55)	6.94 (6.39)	3.45 (3.57)	**0.000****	6.60 (5.17)	4.77 (5.64)	0.024	7.20 (6.49)	4.86 (5.20)	**0.012***

*Source: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-022-12559-5; 1. a t-test 2. b Kruskal-Wallis test 3. * significant at p < .0167 levels 4. ** significant at p < .0033 levels*

Extract from GivingCompass, on a US nationwide survey, conducted by Common Sense Media:

Children from lower-income families spend an average of three and a half hours each day on screen media, according to a nationwide survey conducted by non-profit Common Sense Media. That amount is 40% longer than middle-income children (two hours and 25 minutes) and almost double the screen time spent by affluent children (one hour and 50 minutes).

Also, children whose parents are less educated spend far more time on screens (two hours and 50 minutes) than children whose parents who have graduated from college (one and 37 minutes).

The survey is a snapshot of a moment when parents have begun, increasingly, to fret over screen time. Researchers have noted the number of hours teenagers, particularly, spend on their phones and laptops as a likely factor in the skyrocketing number of adolescents complaining of overwhelming stress and anxiety.

Source: https://www.the74million.org/children-from-low-income-less-educated-families-spend-nearly-twice-as-much-time-on-screens/; https://givingcompass.org/article/children-from-low-income-families-spend-more-time-with-screens/

The social risk of overlooking the information overload trend in the current policy and economic context

There are four consequences that we want to highlight, which are, in our view, the direct consequences of the inadequate awareness of the distortions generated, by digitalisation, on information and, as a result, inadequate tools to address these shortcomings.

Echo chambers and information leadership. People, intentionally and unconsciously, are likely to fall into information channels that reinforce their views, instead of exchanging information from a variety of perspectives. This is due partly to algorithmic self-reinforcement; while, partly, it is intentional behaviour, as people find comfort in views aligned with their expectations. At a time of uncertainty, this becomes a valuable thing. This is further accentuated by people feeling they do not have enough tools to verify information, or they do not have the time or energy to investigate, so they gravitate towards "information leaders" – that is, people that they trust will give them the correct judgement.

This process makes their judgement harder to change, unless the "information leader" changes the assessment. We have seen extreme cases of this, for example, in both politics and from local religious leaders in poor areas. The importance of the leader becomes critical in both the general assessment of an event, as well as a catalyst for activism, including voters' turnout at elections. This process is extremely important for today's electoral behaviour, as we see emerging pockets of people with a limited understanding of issues, but who are more likely to vote, following a certain view, relative to people that acknowledge frustration and confusion with issues, but do not feel they can take the responsibility of choosing between options that they cannot identify with, so they become disenfranchised and inactive in public choices or debate.

Total disengagement. Personal perceptions of the saturation of information that is perceived to be too complex to understand or too painful to be exposed to, including triggering a feeling of alienation and powerlessness, lead to people no longer following developments. This, over time, can also mean that they lose touch with changes, and their ability to decide about future outlooks is impaired because of "old" or "bad" information sets.

Bad choices, due to bad information. Personal choices made on the basis of outright fake news can lead to severe undesirable choices, at both the personal and aggregate levels. The case of extreme anti-vax positions is a recent example.

Lower risk appetite, if the perceived risk is too high: if the perceived personal risk of a future event is perceived to be too great to be mitigated, extreme reactions can materialise. The most heart breaking example of this is a growing number of women that choose to not have children because

of the challenges posed by climate change: both as a direct risk perceived to the new generations and as a personal sacrifice to reduce the carbon footprint.

Share of people at risk of poverty in the EU, as of 2020

	Total	Female
EU27	21.9	22.9
Euro area	22.0	22.9
Belgium	20.4	20.9
Bulgaria	33.6	35.9
Czechia	11.5	13.7
Denmark	16.8	17.3
Germany	22.5	23.3
Estonia	22.8	24.2
Ireland	20.9	21.9
Greece	27.5	28.8
Spain	27.0	28.1
France	18.9	19.7
Croatia	20.5	21.9
Italy	*25*	*25.8*
Cyprus	17.6	18.6
Latvia	25.1	27.6
Lithuania	24.5	26.7
Luxembourg	19.9	20.7
Hungary	19.4	19.4
Malta	19.9	21.8
Netherlands	16.0	16.4
Austria	16.7	17.1
Poland	17.0	17.9
Portugal	20.0	20.9
Romania	35.8	37.5
Slovenia	14.3	15.2
Slovakia	13.8	14.2
Finland	15.9	15.6
Sweden	17.7	18.8
Norway	16.3	17.5
Switzerland	18.4	19.1

*Source: Eurostat; **Italy only has data for 2019*

Uncertainty, forecasting and different time horizons

How people address uncertainty at a basic level?

Our experience in trying to understand how people make choices regarding a future event that is uncertain and complex highlights three types of strategies, so to speak, that we all use.

First, people communicate and try to understand complexity – that is, the complexity of something that may reveal itself over time – by synthesising a message via art: imagery, music and storytelling or theatre are all vehicles that are supremely effective in conveying complexity to other people. The power of these vehicles, vs. written text or a table of numbers, is that they are better at conveying emotions and intent; and, by doing that, the informational content of these vehicles is greater than simple written text.

Second, they form opinions on the likelihood of an event based on their experience and that of the people around them, and they mix this with some data available in print (or a similar channel). Ultimately, people try to address a variety of future uncertainties with simple behavioural rules: don't walk alone at night after a certain hour; don't drink water from a dirty source; save a certain amount every month, and so on.

The third layer is connected with values. Values are socially constructed and, therefore, can be very different on many levels, but people choose – especially in very uncertain situations – on the basis of what they think is most closely aligned with their values, and they choose representatives on the basis of what they think are the other person's values.

The point where biological risk assessment and big data meet

Our experience as sell side professional forecasters tells us that there are three key roles that this service fulfils:

1) Providing an accurate of prediction of an event that will unfold within a short period of time (0 to 24 months).
2) Strategic/scenario building for the medium-long term to assist strategic decision making.
3) Highlighting/ revealing/ analysing to assist planning for non-linear, extreme events – such as a nuclear event.

Accuracy is the most important in the first and loses relevance in the others, where the emphasis is on choices instead, and preparation.

There are three dimensions that one must keep in mind when trying to build a forecast about the future:

- **Measure the measurable, understand it thoroughly and model it.** This is the most obvious step and where we are trying to put most emphasis as a society. Gathering, codifying, standardising data and, ideally, this comes together with genuine understanding of the limits and content of what we are using.

- **Try to understand what you know exists, but what you don't have in codified or structured form.** You need to be aware, or make sure, that you look for data that should be included in the analysis, but may not be codified easily; therefore, you cannot utilise a rigorous statistical approach, but it should be, nonetheless, included in the overall analysis somehow. A good example is how we can price in the relevance of geopolitical tensions in financial analysis.

- **Be alert to the unknown and unmeasured.** You need to be at least conscious of the fact that you might be missing something important in the event you are analysing; however, for the time being, you do not know what it is and you may not even be able to codify it either. Ideally, you want a system

that allows you to flag these factors eventually. This step is where biological risk assessment is superior to risk assessment, which is based purely on data. We screen for even faint signals of something that could be relevant to us from body language, behavioural pattern or whatever else that attracts our attention. However, on top of this, there is another aspect that is important and relevant to the risk of big data and its extensions.

Big data increases the visibility of measured performance, implicitly reducing our attention on what we do not measure or we do not know yet. Machine learning and artificial intelligence could also undermine, by reducing human skills in making certain links. We already know well that complex algorithms provide answers that humans cannot fully trace and, therefore, cannot fully explain; and, in doing so, it presents us with a dilemma: either use a recommendation we do not understand, or ignore the recommendation, which would undermine the very reason to use the algorithm.

The role of the public sector

The public sector is in a unique position to support a positive digital transition. Its significant size in any economy means that it has the scale to invest in building holistic knowledge about the strength and weaknesses of this technology; it can set and enforce standards that will have cascading effects on the economy; and it can lead by example, and support transparent debate and fact finding, to the benefit of all aspects of life.

Challenge 1: lagging behind on data and skills

The key ingredients of high growth, post war, was universal literacy, schooling, and growing investment and coordination in public statistics. Today, we are creating an imbalance of big data creation and manipulation more skewed to the private sector.

Multiple challenges, as a result

1. Perceived superiority of private data over public, because more visible, more abundant, more human skills in manipulation. However, what is not visible is that much of this data manipulation is used and created only to maximise commercial goals.
2. Professional skills developed more abundantly in the private sector, if the public sector does not catch up.
3. Education professions unbalanced and poorly holistically prepared to train the next generations, private interest in education creates a bias towards certain aspects of education that do not necessarily lead to a better long-term outcome.
4. Lower visibility of public information or primary source of information, and limited knowledge on how to screen information, lead people to be misled, breeds mistrust, and it is difficult to convey messages, especially in times of crisis.

Challenge 2: funding constraints and current priorities limit public balance sheet reorganisation

At the time of writing this report, Russia's invasion of Ukraine has, over a very short period of time, generated multiple challenges for public finances on both a short and long-term basis:

a) It will boost the need to increase defence spending, easily by 1% of GDP annually, on average, going forward, in the EU.

b) It will increase the need for fiscal support as a result of soaring energy prices – this could be direct energy price implications or income support measures; either way, 1-2% of GDP annual extra spending on this appears a realistic unspoken prospect.

c) It will halt the economic recovery, probably putting the European economy in recession soon, and the drop in public revenues that this will imply in the near term.

These challenges come on top of the economic and administrative strain from the need to facilitate the green and digital goals of the EU. Therefore, it looks almost implausible, today, to talk about increasing financial, intellectual and professional public resources towards supporting human capital and competition – the ingredients that we believe are necessary for a healthy digitalisation transition.

Challenge 3: an unbalanced labour market exacerbates inequality and is a challenge to boosting productivity

Digitalisation has an uneven impact on the labour market, because it boosts tertiary-educated job positions and compensation, while it penalises less educated employment. According to Eurostat data, the share of tertiary-educated employment ranges from a low of 24% in Italy to a high of 48% in Cyprus; in the aggregate, the EU has 39% of workers with tertiary educations. In the US, the share of workers with some college or a Bachelor's degree is 69%.

This shift has an important gender aspect: in the EU today, the majority of graduates with tertiary education are women – the exceptions being Germany and Lichtenstein. In the US, according to data from *educationdata.org*, as of 2019, 56% of graduates with an Associate or Bachelor's degree were women, and 53% of graduates with a Masters or higher were women. The same happens with graduates in the "hard" sciences: science, maths, computing, engineering, manufacturing and construction – Eurostat data show that we have more women graduates in the 20-29 year cohort than men, with the only exception being Switzerland.

Therefore, women are ideally positioned to benefit from the digitalisation of the economy; however, so far, their working lives remain meaningfully shorter than that of men, which is a way to synthetise what is evident to anyone anecdotally: women across education levels are far more likely to leave the labour force due to family commitments than men. Even with easier remote working solutions, we believe that, as things stand, women will continue to leave the labour force too early, often around the time when their productivity could be highest due to their experience, because there is a vast under provision of children care facilities that meet the needs of a professional career appropriately. Importantly, poverty statistics show very little improvement in poverty rates in the EU among children (under 18 years old) and a continuing pattern of the high incidence of poverty risk among families, especially single mothers. This is also true when we look at the poverty rates post transfers. These numbers, *de facto*, show that there is a cascading effect on the next generation as, in an economy where education becomes a critical ingredient for income prospects, children from poor income backgrounds face incredibly tough conditions.

Employment by educational attainment

From 15 to 64 years

	Less than primary, primary and lower secondary education (levels 0-2)	Upper secondary and post-secondary non-tertiary education (levels 3 and 4)	Tertiary education (levels 5-8)
European Union - 27 countries (from 2020)	31,038	92,972	71,175
Euro area - 19 countries (from 2015)	27,135	66,146	55,739
Belgium	558	1,815	2,500
Bulgaria	327	1,686	1,029
Czechia	215	3,533	1,358
Denmark	510	1,163	1,121
Germany (until 1990 former territory of the	5,526	22,535	12,550
Estonia	59	293	269
Ireland	224	835	1,248
Greece	634	1,818	1,559
Spain	5,812	4,883	9,059
France	3,393	11,532	12,462
Croatia	124	1,084	470
Italy	6,509	10,475	5,219
Cyprus	55	160	211
Latvia	54	441	339
Lithuania	53	620	649
Luxembourg	48	87	161
Hungary	489	2,648	1,424
Malta	77	95	90
Netherlands	1,623	3,490	3,966
Austria	542	2,200	1,581
Poland	770	9,594	6,013
Portugal	1,559	1,468	1,651
Romania	897	5,048	1,744
Slovenia	63	510	406
Slovakia	68	1,719	765
Finland	278	1,169	1,054
Sweden	571	2,072	2,276
Iceland	40	76	76
Norway	470	950	1,253
Switzerland	585	1,943	1,956

Source: Eurostat

Bibliography

Understanding risky behavior, the Influence of Cognitive, Emotional and Hormonal Factors on Decision-Making under Risk; Kusev et al 2017, Frontiers in Psychology

The roles of dopamine and serotonin in decision making, Rogers, Neuropsychopharmacology, 2011

The nexus between decision making and emotion regulation: A review of convergent neurocognitive substrates, Mitchell, Behavioural brain research, 2010

Loewenstein, G., & Lerner, J. S. (2003). The role of affect in decision making. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 619–642). Oxford University Press.

The national child traumatic stress network: https://www.nctsn.org/what-is-child-trauma/about-child-trauma

UNICEF – Global development commons blog on How does social and emotional development affect learning? https://gdc.unicef.org/resource/how-does-social-and-emotional-development-affect-learning

The Impact of Family Education Savings on Children's Academic Performance—An Empirical Research Based on CFPS2018 Data – Yanfei Liu, Wenjing Zhang – paper presented in the 4th international seminar on education, management and social sciences. (https://www.researchgate.net/publication/345079832_The_Impact_of_Family_Education_Savings_on_Children%27s_Academic_Performance-An_Empirical_Research_Based_on_CFPS2018_Data)

The relationship between screen time among children and lower economic status during elementary school closures due to the COVID19 2019 pandemic – Sangha Lee, Sungju Kim, Sooyeon Suh, Hyojin Han, Jaeoh Jung, Sujin Yang Yunmi Shin (https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-022-12559-5)

The giving compass organization - https://givingcompass.org/article/children-from-low-income-families-spend-more-time-with-screens/

Social Class in the 21st century – Mike Savage

Saggezza antica Terapia per i mali dell'uomo d'oggi – Giovanni Reale

Statistics, Public Debate and the State, 1800-1945 – Jean-Guy Prevost and Jean-Pierre Beaud

Fooled by randomness – Nassim Nicholas Taleb

Talking to strangers – Malcom Gladwell

The sexual paradox – Susan Pinker

The cyber effect – Mary Aiken

A model of online misinformation – Daron Acemoglu, Asuman OZdaglar, James Sireius (https://economics.mit.edu/files/22760)

Harms of AI – Daron (https://economics.mit.edu/files/21848)

The perverse consequences of policy restrictions in the presence of asymmetric information Larcinese on policy and lower return on political information -Hortala-Vallve, Rafael and Larcinese, Valentino (2017) (http://eprints.lse.ac.uk/67505/)

The ongoing role of machine learning engirnners and data scientists in industry's Lucas critique – Scott Cunningham (https://causalinf.substack.com/p/the-role-of-machine-learning-engineers?utm_campaign=post&utm_medium=web&utm_source=direct&s=r)

Telecracy: Testing for Channels of Persuasion – Guglielmo Barone, Francesco D'Acunto, Gaia Narciso (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2192970)

Emotional Intelligence: Why It Can Matter More Than IQ – Daniel Coleman

OECD Survey of adult skills (PIAAC): https://www.oecd.org/skills/piaac/

https://www.slideshare.net/OECDEDU

https://www.slideshare.net/DataReportal/digital-2020-global-digital-overview-january-2020-v01-226017535

Disclaimer

TERMS AND CONDITIONS OF USE

YOU AGREE THAT YOU ARE USING THIS REPORT AND THE ADA Economics Ltd ("ADA") SERVICES AT YOUR OWN RISK AND LIABILITY. NEITHER ADA NOR ANY DIRECTOR, OFFICER, EMPLOYEE OR AGENT OF ADA ACCEPTS ANY LIABILITY WHATSOEVER FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, MORAL, INCIDENTAL, COLLATERAL OR SPECIAL DAMAGES, OR LOSSES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, THOSE DAMAGES ARISING FROM ANY DECISION MADE OR ACTION TAKEN BY YOU IN RELIANCE ON THE CONTENT OF THIS REPORT, OR THOSE DAMAGES RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER FROM THE USE OF OR INABILITY TO USE ANY CONTENT OR SOFTWARE OBTAINED FROM THIRD PARTIES REQUIRED TO OBTAIN ACCESS TO THE CONTENT, OR ANY OTHER CAUSE, EVEN IF ADA IS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR LOSSES, AND EVEN IF CAUSED BY ANY ACT, OMISSION OR NEGLIGENCE OF ADA OR ITS DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS, AND EVEN IF ANY OF THEM HAS BEEN APPRISED OF THE LIKELIHOOD OF SUCH DAMAGES OCCURRING.

This report may provide information, commentary on and the discussion of issues relating to the state of the economy and the capital markets. All opinions, projections and estimates constitute the judgment of the author as of the date of the report and are subject to change without notice. ADA is under no obligation to update this report and readers should therefore assume that ADA will not update any fact, circumstance or opinion contained in this report.

The content of this report is provided for discussion purposes only. Any forward-looking statements or forecasts included in the content are based on assumptions derived from historical results and trends. Actual results may vary from any such statements or forecasts. No reliance should be placed on any such statements or forecasts when making any investment decision, and no investment decisions should be made based on the content of this report.

This report is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and particular needs of any specific person. Under no circumstances does any information represent a recommendation to buy or sell securities or any other asset, or otherwise constitute investment advice. Investors should seek financial advice regarding the appropriateness of investing in specific securities or financial instruments and implementing the investment strategies discussed or recommended in this report.

This report should not be regarded by recipients as a substitute for the exercise of their own judgment and readers are encouraged to seek independent, third-party research on any companies discussed or affected by this report.

Securities and other financial instruments discussed in this report are not insured and are not deposits or other obligations of any insured depository institution. Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counter-party default risk and liquidity risk. No security, financial instrument or derivative is suitable for all

investors. In some cases, securities and other financial instruments may be difficult to value or sell, and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that the price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

Individuals identified as economists in this report do not function as research analysts. Under U.S. law, reports prepared by them are not research reports under applicable U.S. rules and regulations.

In accordance with rules established by the U.K. Financial Services Authority, macroeconomic analysis is NOT considered investment research.

Materials prepared by ADA research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of ADA.

To the extent that this report discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this report. ADA research personnel's knowledge of legal proceedings in which any ADA entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving companies mentioned in this report is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, nor discussed with, and may not reflect information known to, professionals in other business areas of ADA in connection with the legal proceedings or matters relevant to such proceedings.

The information herein (other than the disclosure information relating to ADA and its affiliates) was obtained from various sources and, while all efforts have been made to provide accurate information, ADA does not guarantee its accuracy. This report may contain links to third-party websites. ADA is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this report and is not incorporated by reference into this report. The inclusion of a link in this report does not imply any endorsement by or any affiliation with ADA.

Any unauthorised use or disclosure is prohibited.

Contacts

ADA Economics Ltd.

79, Alvington Crescent,

London, E8 2NN, UK

Research: ADA_Research@adaeconomics.com

Sales: ADA_ResearchAdmin@adaeconomics.com

Tel. +44 7594 704 277

The ADA Team

Raffaella Tenconi

Founder & Managing Director

raffaella@adaeconomics.com

Alessio Chiesa

Economist

Exchange Rates & Bond yields specialist

alessio.chiesa@adaeconomics.com

Adnan Asif

Economist

Monetary Policy specialist

adnan.asif@adaeconomics.com

Viola Pititto

Digital Experience & Creative Director

viola.pititto@adaeconomics.com

Aditi Mehrotra

Analyst

aditi.mehrotra@adaeconomics.com

Julia Toth

Digital Marketing Assistant

julia.toth@adaeconomics.com